

EMCal: Effect of material (in the acceptance of PWO EMCal)

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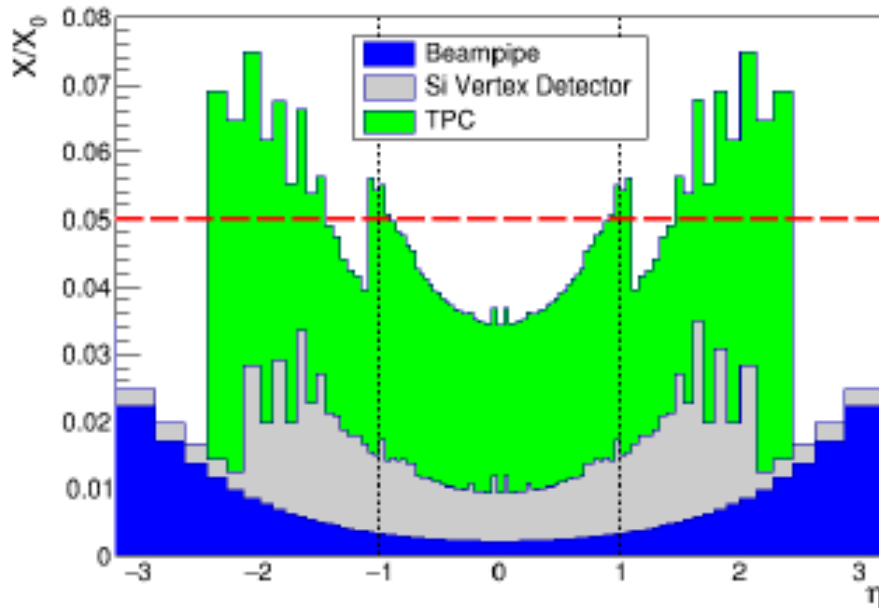
EIC-YR-Calorimetry meeting

June 30, 2020

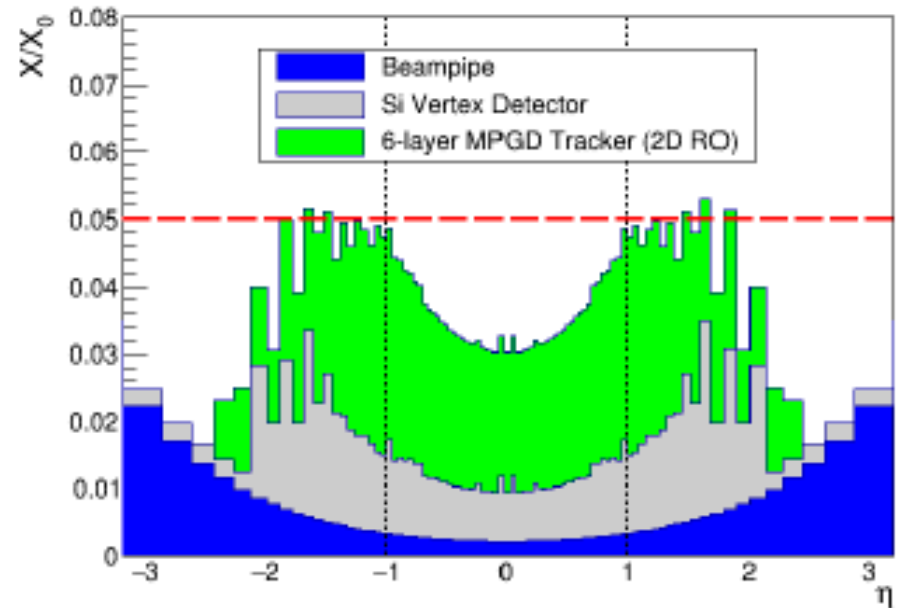
Tracking scenarios

Tracking group at Pavia meeting:
Two tracking scenarios

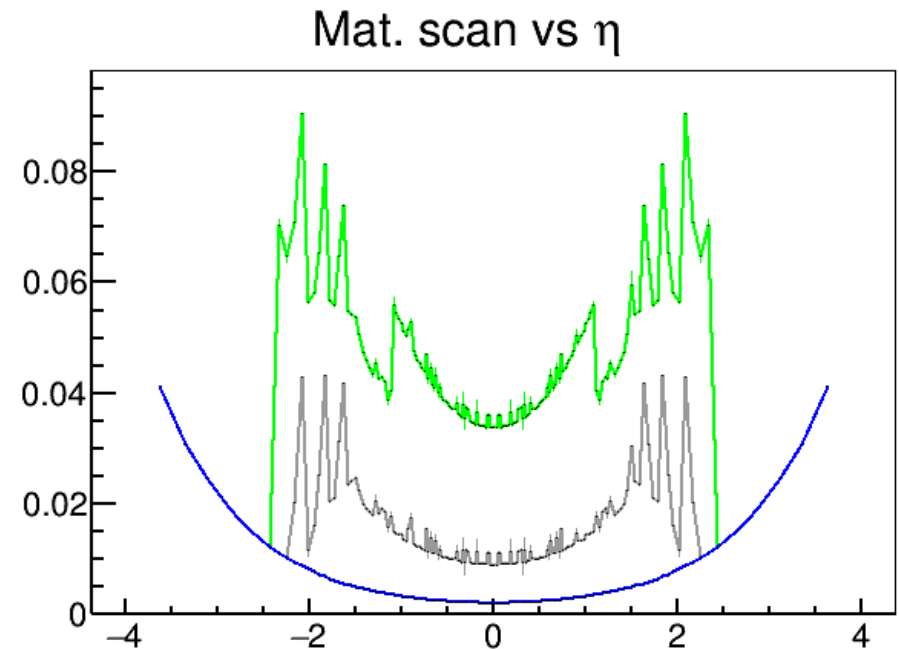
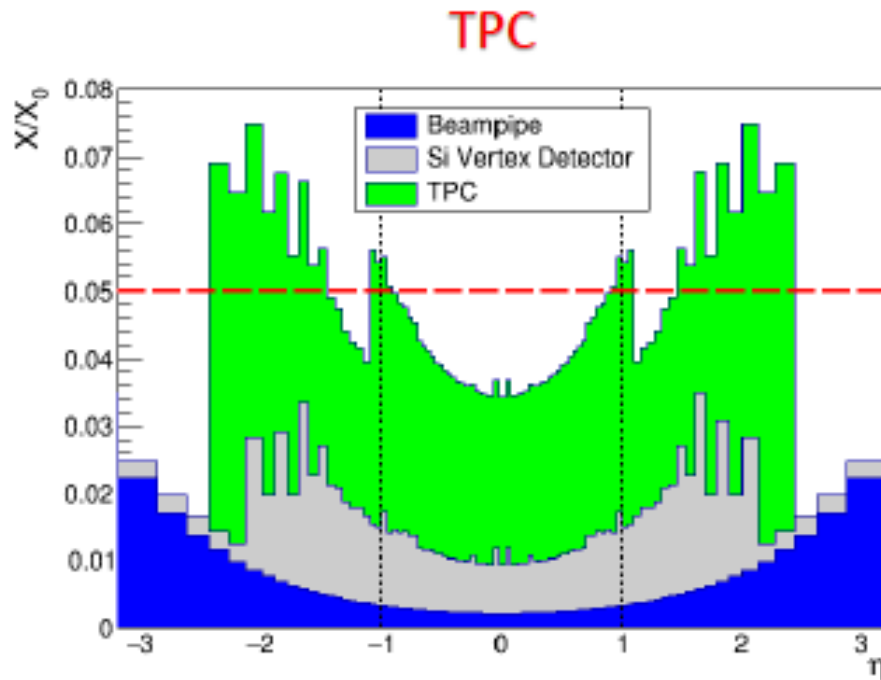
TPC



6-layer 2D RO MPGD tracker

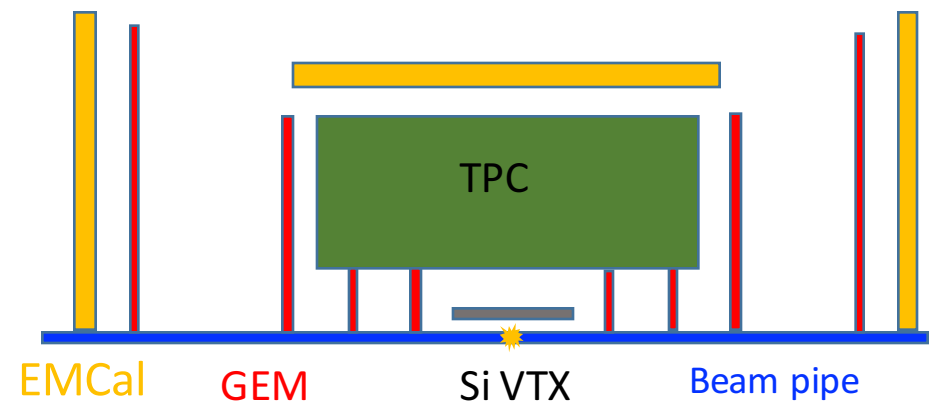


Tracking group' vs my setup

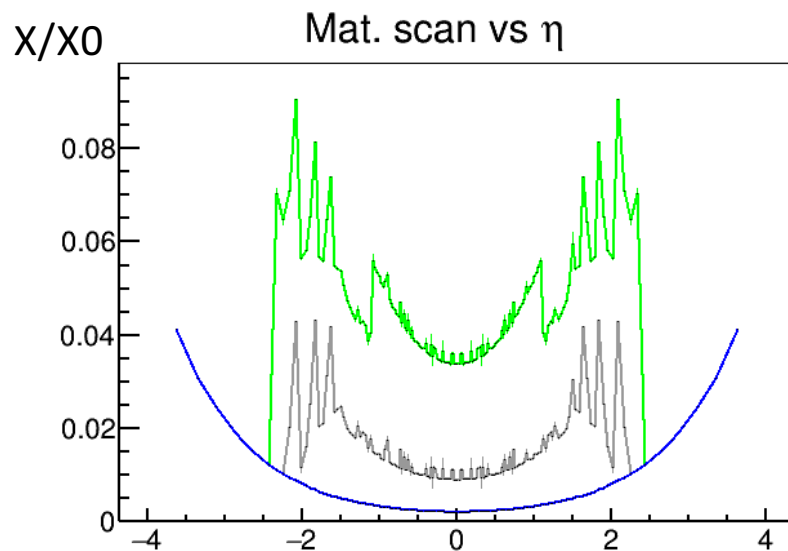


Similar setups (probably the same)
... but still no endcap trackers

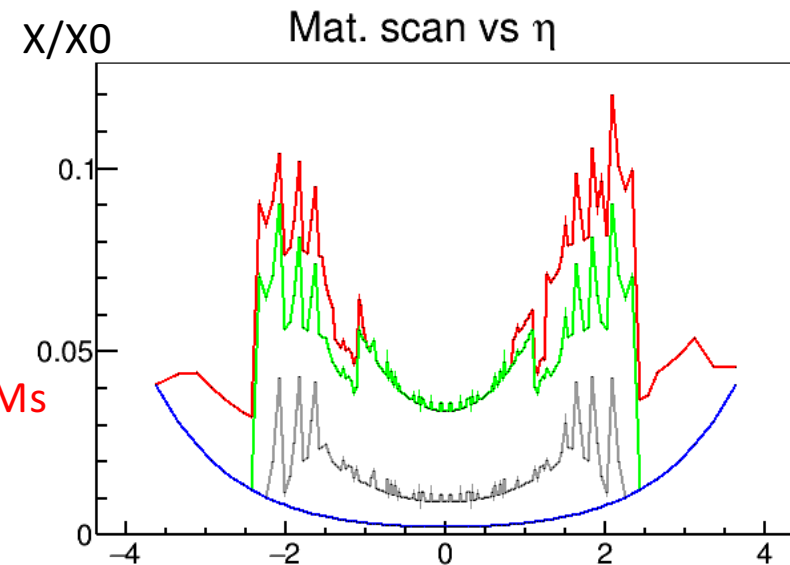
Add endcup tracker



No PID detectors
No support/service material



Beam pipe
Vertex Si
TPC
Endcup GEMs

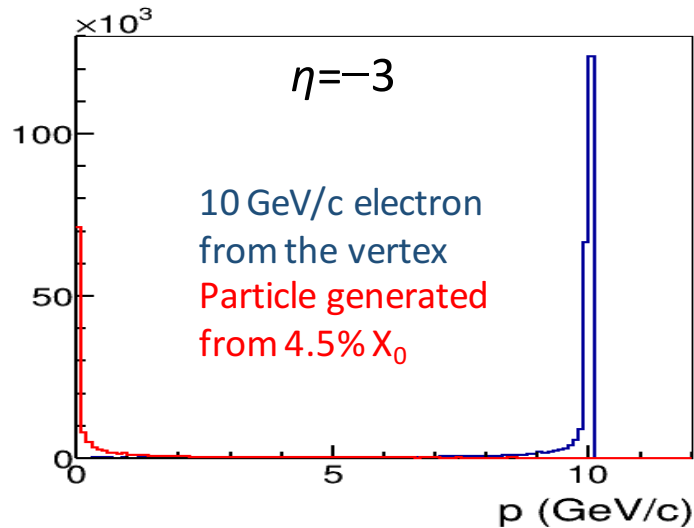


GEM: $\sim 0.7\%$ of X_0 per plane

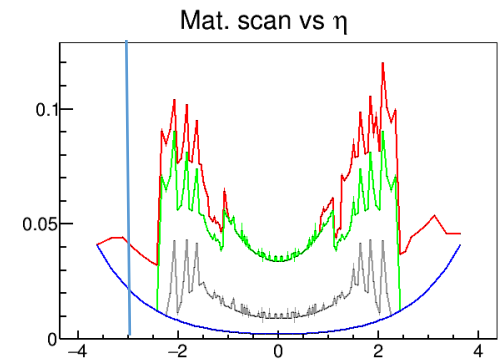
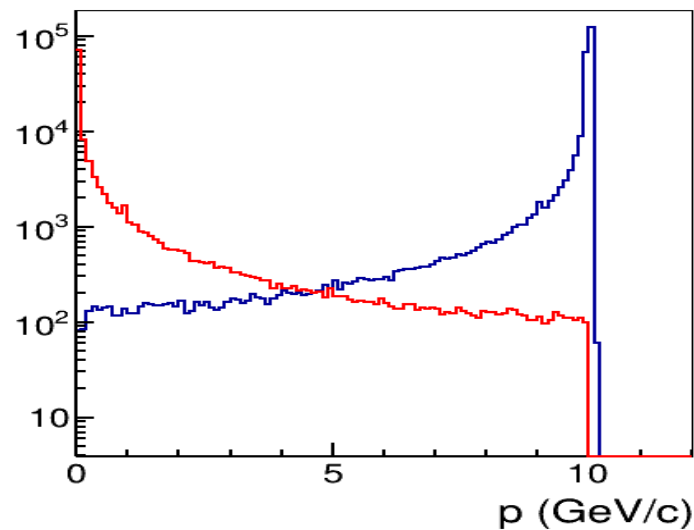
What hits the EMCal

After $\sim 4.5\%$ of X_0

Lin.
scale



Log.
scale



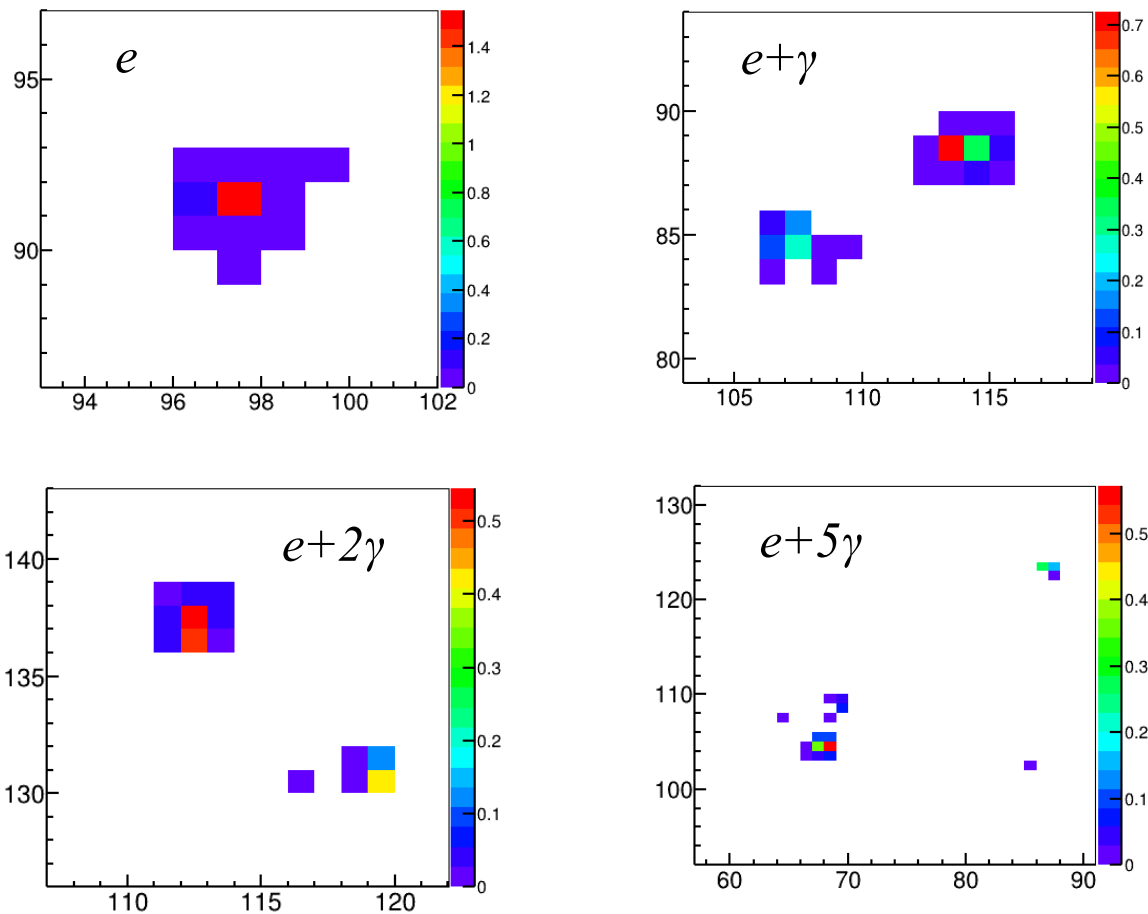
Single 10 GeV/c electrons generated

How EMCal sees electron events

After $\sim 4.5\%$ of X_0 ($\eta = -3$) and magnetic field

Single 2 GeV electrons simulated

Energy in EMCal towers



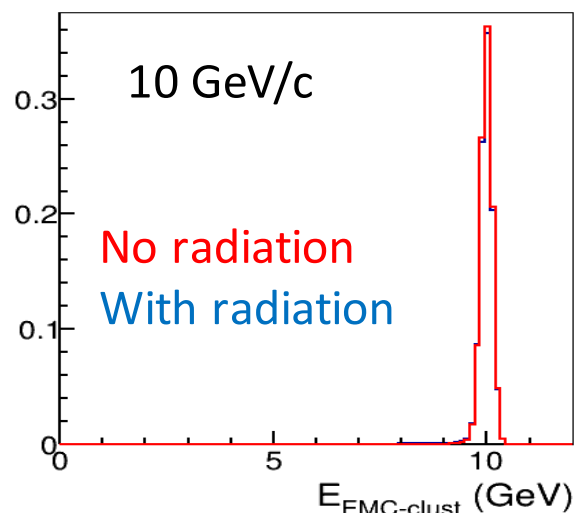
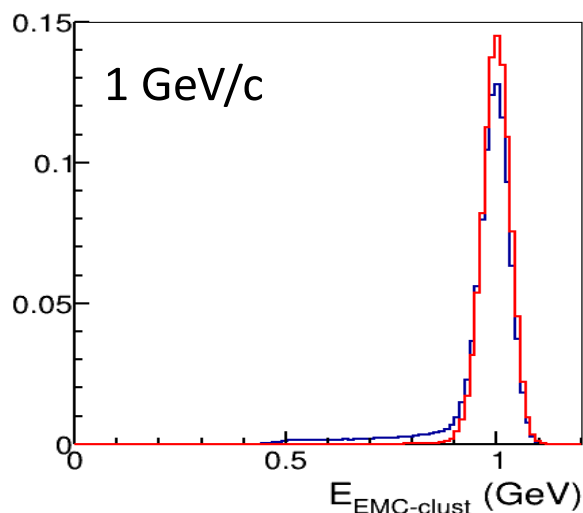
How EMCal measures electrons

Single electrons generated
Maximal EMCal energy cluster shown (in PWO)

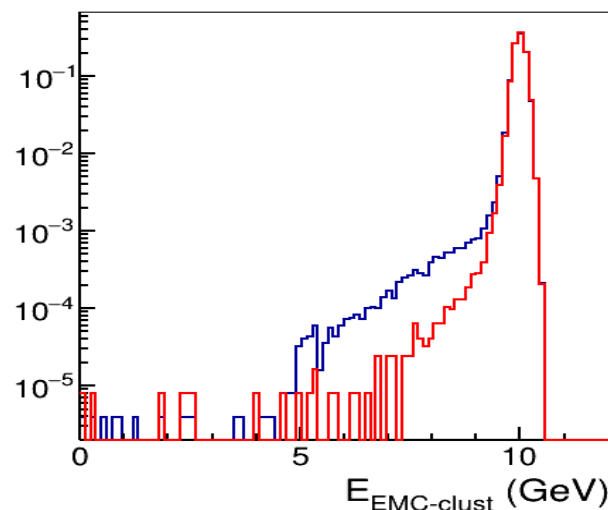
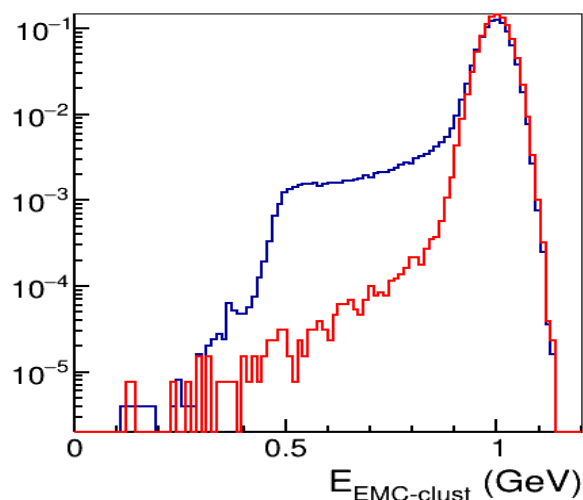
How electron is
“modified” as
seen by the
EMCal

$\eta = -3$

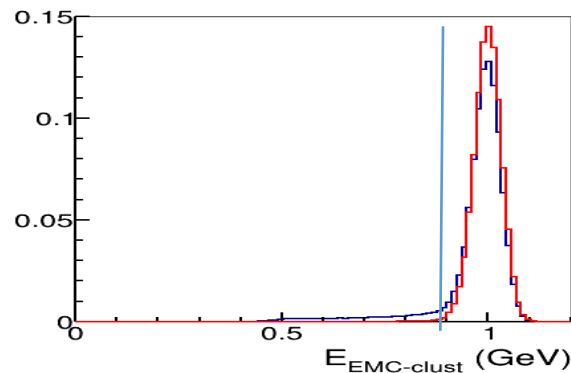
Lin.
scale



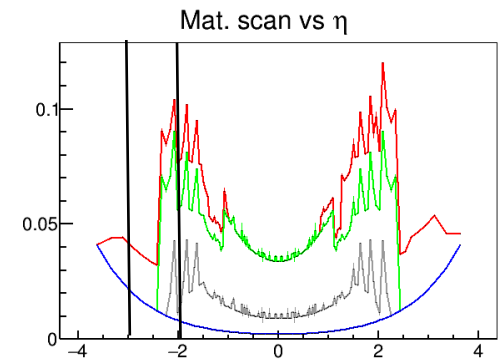
Log.
scale



“Efficiency” of e reco

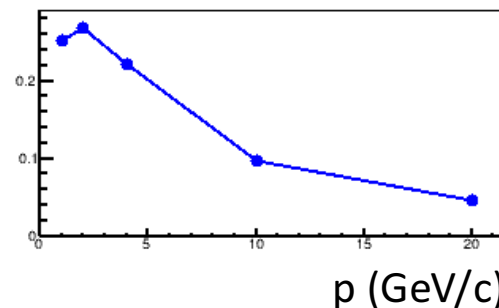
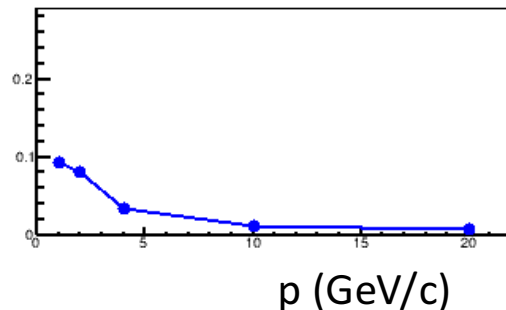
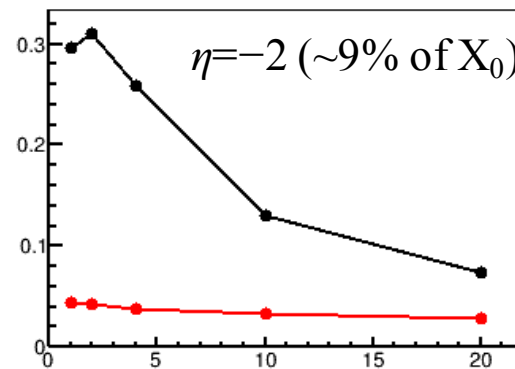
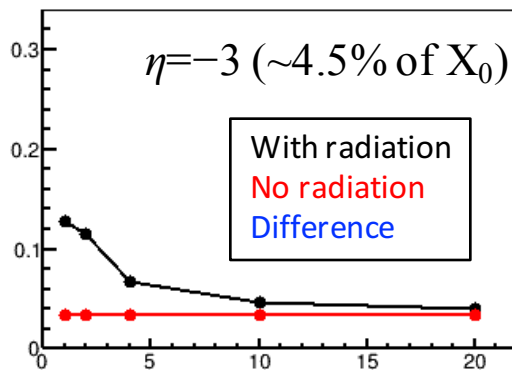


$$E_{\text{EMC}} > E_{\text{nom}} - 2 \sigma_{\text{EMC}}$$



How electron is
“modified” as
seen by the
EMCal

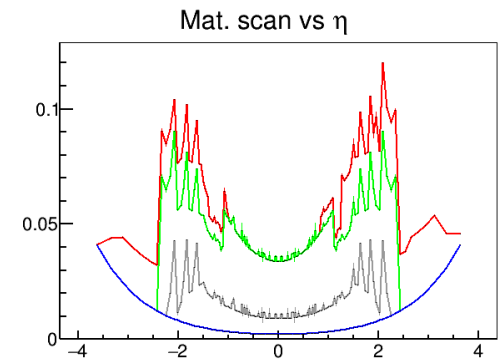
Losses vs p (GeV/c)



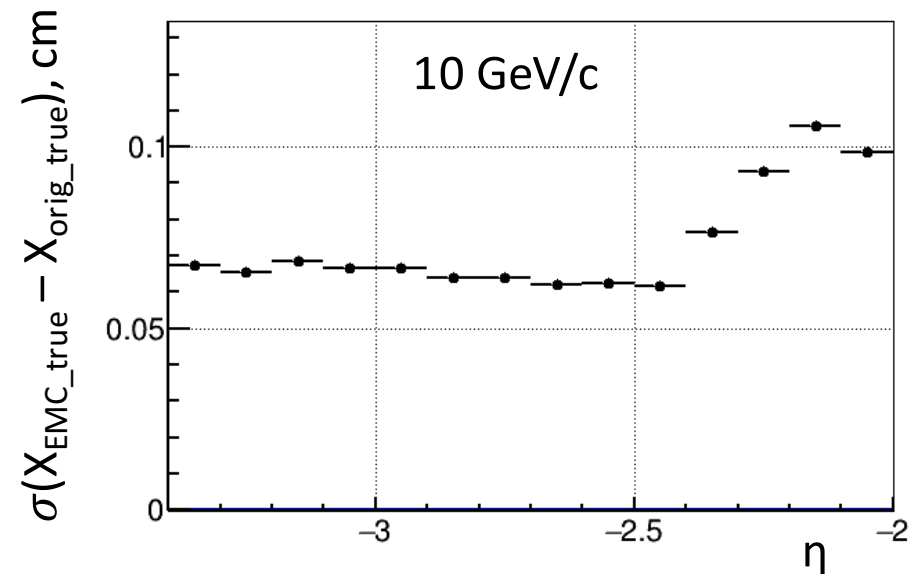
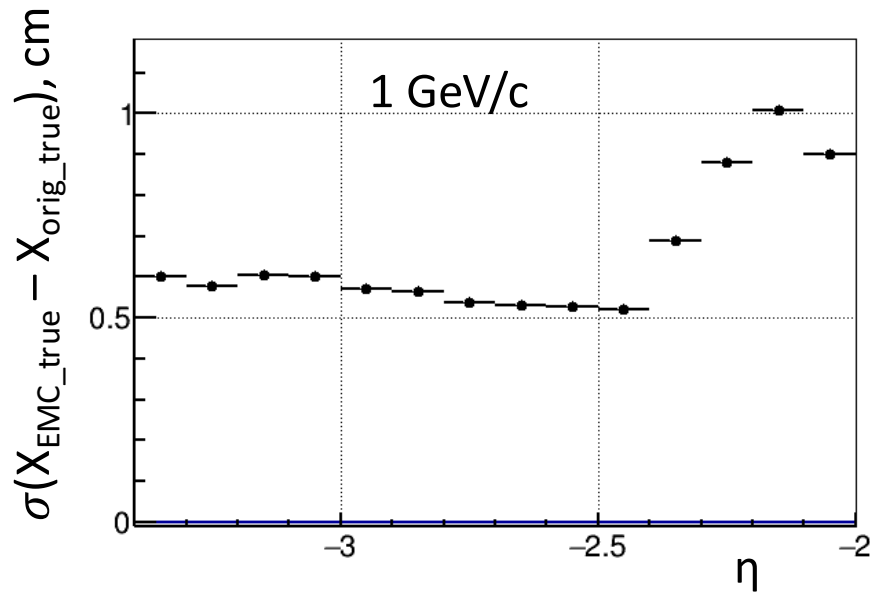
Expected to be 2.3%
for a pure gaussian
response

Huge effect from
 $\eta = -3$ to $\eta = -2$

Effect of multiple scattering before the EMCal



Electron position smearing (in cm) at the PWO EMCal due to multiple scattering

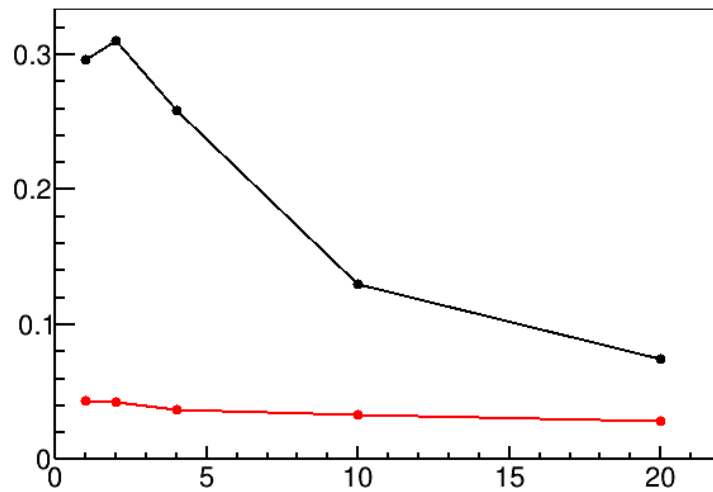


Compare to $\sigma_X^{EMC} \sim \frac{3mm}{\sqrt{E}} + 1mm$

Backup

$$\frac{\sigma_E}{E} = \frac{2.5\%}{\sqrt{E}} \oplus 1\%$$

Eff. vs p (GeV/c)



$$\frac{\sigma_E}{E} = \frac{7\%}{\sqrt{E}} \oplus 1.5\%$$

Eff. vs p (GeV/c)

